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Collateral Relatives of American Indians Among the Bronze Age Populations of Siberia?

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ABSTRACT Nonmetric and metric traits were studied in cranial series representing prehistoric and modern populations of America and Siberia. Frequencies of the infraorbital pattern type II (longitudinal infraorbital suture overlaid by the zygomatic bone) are universally lower in Amerindians than in Siberians. The os japonicum posterior trace, too, is much less frequent in America than in Siberia. The only two Siberian groups with an almost Amerindian combination are late third to early second millennium BC populations from Okunev and Sopka, southern Siberia. The multivariate analysis of five nonmetric facial traits and ten facial measurements in 15 cranial series reveals two independent tendencies. One of them shows a contrast between prehistoric Siberian Caucasoids and modern Siberian Mongoloids; the second one sets Amerindians apart from others. Prehistoric people who lived west of Lake Baikal and modern Uralic speakers are intermediate between Siberian Caucasoids and Siberian Mongoloids; Eskimos, Aleuts, and Chukchi are intermediate between Siberian Mongoloids and Amerindians; and Okunev and Sopka are intermediate between Siberian Caucasoids and Amerindians. Our results suggest that people of Okunev and Sopka are collateral relatives of Amerindians with some Caucasoid admixture. Am J Phys Anthropol 108:193–204, 1999.

The search for biological links between the native human populations of America and Siberia has been going on for decades on both sides of the Atlantic. Hrdlička (1925) has convincingly demonstrated that American Indians (henceforth Amerindians) descended from the Mongoloids[1] who had migrated from Siberia via the Bering route in the Late Paleolithic. However, although this idea has been supported by a large body of biological evidence (Szathmáry, 1985, 1993), even today there is little hope of finding direct ancestors of Amerindians in Siberia, as human skeletal remains older than 10,000 years are quite scanty. At best, we can expect to find their collateral relatives—that is, people who had had common ancestors with the Amerindians but had remained in Siberia. Based on cranial observations, Hrdlička (1942) suggested that people of the Chalcolithic Afanasyev culture of southern Siberia as well as the Neolithic and Chalcolithic inhabitants of the area west of Lake Baikal were very similar to Algonquins and Californian Indians, respectively, and might thus have been their collateral relatives.

After having measured the racially diagnostic facial and nasal profile angles ignored by Hrdlička, Debetz (1947) refuted this idea

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[1]The terms *Mongoloids* and *Caucasoids* used in this article refer to large geographical subdivisions of the human species (for their modern definition see Howells, 1996). These subdivisions must not be regarded as closed entities or static types but rather as "local limitations of the global variation in universal human traits" (Howells, 1996:389).

with respect to Afanasyev people who, unlike most native Americans, exhibited pronounced Caucasoid features—that is, had sharply profiled faces and strongly protruding noses. However, he supported Hrdlička's view with respect to the prehistoric Baikalians, who were basically Mongoloid but displayed a slight Caucasoid tendency. According to Debetz (1951), available craniological methods cannot distinguish Amerindians from Mongoloids with some Caucasoid admixture.

Indeed, Alexseev (1979b, 1985a,b), who had measured the facial angles in several Amerindian cranial series, concluded that hybridization between Amerindian ancestors and Caucasoids did occur in Central Asia or southern Siberia. Caucasoid dental affinities of the Late Paleolithic child from Malta, Irkutsk (Turner, 1986), support this view, although in an indirect way.

For Debetz, however, the admixture (apart from the recent one, of course) was not an established fact; rather, he tended to agree with Roginsky (1937), who believed that the ancestors of the Amerindians had left the Old World before the classical Mongoloid facial morphology originated in Asia. Howells, whose multivariate cranial studies confirmed the presence of a Caucasoid tendency in Amerindians (Howells, 1989), was also uncertain whether this was due to actual admixture or to the lack of Mongoloid specialization (Howells, 1977). At present, the second suggestion appears more likely in view of an apparently late date (possibly only 11 thousand years BP) of the Late Paleolithic skulls from the Upper Cave of Zhoukoudian, China (Kamminga, 1992). These people lacked distinct Mongoloid features and resembled Amerindians (Weidenreich, 1939; Birdsell, 1951; Neumann, 1956; Kamminga and Wright, 1988; Van Vark and Dijkema, 1990; Kamminga, 1992). Also, neither genetic (Szathmáry, 1985, 1993) nor dental data (Turner, 1985, 1986) support the idea of an appreciable pre-Columbian Caucasoid admixture in native Americans.

Returning to the search for collateral relatives of Amerindians in the Old World, the Neolithic and Chalcolithic tribes of the Baikal area can no longer be regarded as likely candidates. Thanks to the appearance of a large series of radiometric dates (Mamonova and Sulerzhitsky, 1989), it has become evident that the similarity between American natives and prehistoric Baikalians is not due to common ancestry. Contrary to expectation, the earliest known inhabitants of the Baikal area, who lived there in the sixth and fifth millennia BC, were extremely flat-faced Mongoloids. Their descendants began to look less Mongoloid (and accordingly more Amerindian) only in the fourth millennium BC, and this tendency continued in the 3d millennium BC (Alexseev et al., 1987). Clearly, the only possible explanation is gene flow from the more western regions of southern Siberia inhabited by the Caucasoids. The resulting similarity of late Baikalians with the Amerindians, then, is superficial and irrelevant for the initial peopling of America.

In the recent years, two opposite tendencies became evident with regard to nonmetric (discrete, or epigenetic) cranial characters, also known as cranioscopic traits. One tendency was to stop using these traits in population comparisons. The disappointment was caused by erratic patterns of group relationships revealed by the use of large batteries of random and taxonomically uninformative characters. Studies based on this approach were quite numerous in the 1970s and '80s, but then their number dramatically decreased (for more details see Kozintsev, 1992a).

Another tendency was to pay more attention to the careful selection of informative traits (Dodo, 1987; Tomashevich, 1988, 1990; for important data concerning the distribution of discrete cranial characters in northwestern North America see also Ossenberg, 1994). A battery of diagnostic traits, some of them new and some old, was suggested by us, and their efficiency in revealing prehistoric human affinities and tracing migrations was demonstrated on the world level (Kozintsev, 1988, 1990, 1992a,b; Kozintsev and Moiseyev, 1995; Moiseyev and Kozintsev, 1998). The number of skeletal populations studied by us has reached 130, and the total number of individuals has surpassed 10,000.

Amerindians proved to possess a very specific combination of traits; extremely low frequencies of the infraorbital sutural pattern type II and transverse zygomatic su-

ture trace make them quite distinct from both Caucasoids and Siberian Mongoloids (Kozintsev, 1991). Because Eskimos, Aleuts, Chukchi, and Chinese are intermediate between Siberians and Amerindians in these traits (Kozintsev, 1992a) while being dentally similar to both (Turner, 1985, 1986), one of us suggested that northern China rather than Siberia was the likely homeland of Amerindian ancestors (Kozintsev, 1995).

But as soon as this view had been published, the same combination of nonmetric traits was discovered in a Bronze Age population from southern Siberia: people of Okunev culture (Kozintsev et al., 1995; Gromov, 1996). This finding paralleled Lipsky's (1969) observations concerning similarities between Okunev anthropomorphous burial stelae and certain elements of North American Indian ritual art, especially the designs decorating the faces, carved on stone in the former case and painted in the latter.

The general objective of the present study was to integrate available craniometric and cranioscopic data relevant for tracing prehistoric affinities between Siberia and America. Our more specific purpose was to find out which if any ancient Siberian populations may be viewed as the likely collateral relatives of Amerindians.

MATERIALS AND METHODS

This study is based on metric and nonmetric cranial traits in 15 groups, both modern and ancient. The location of prehistoric Siberian and Kazakhstanian groups is shown in Figure 1.

Measurements were taken from various sources (listed below). All nonmetric data are ours. Regrettably, in some cases the two sets of traits were not obtained from the same sets of samples. This mostly applies to three populations pooled from very large territories: modern Caucasoids and American Indians (both North American and South American). Although this may have made the results pertaining to various sets of traits less comparable than one would be willing to accept, it is unlikely that any serious bias has been introduced. Indeed, despite considerable variation within the geographical areas, all samples used may in a certain sense be regarded as equally representative for these areas, as demonstrated by the general agreement between the two systems of traits (see below, especially Fig. 2).

1. Caucasoids. Frequencies of nonmetric traits in 29 modern samples representing 21 linguistically diverse ethnic groups of eastern and northern Europe, Caucasus, the Near East, and Pamirs were pooled, and so were metric data for 23 samples representing 15 of these ethnic groups; sources from which the measurements were taken are listed in Kozintsev and Moiseyev (1995) and Moiseyev and Kozintsev (1998). Groups for which both metric and nonmetric data were used are as follows (number of samples and number of individuals are given in parentheses): Russians (2 samples, 224), Ukrainians (29), Letts (61), Lithuanians (2 samples, 115), Estonians (27), Finns (6 samples, 479), Swedes (105), Karelians (106), Abkhasians (59), Adygeys (57), Ossets (2 samples, 209), Chechens (25), Ingushes (59), Armenians (121), and Pamirians (36). Groups in which only nonmetric traits were studied are Poles (33), Hungarians (38), Bulgarians (31), Italians (36), Turks (33), and Arabs of Syria, Lebanon, and Jordan (124). The total number of individuals is 2,007 (for more details concerning local populations see Kozintsev, 1992a).

2. Uralians. This is a pooled modern western Siberian sample representing peoples who speak Uralic languages: Ob Ugrians, viz. Khanty (6 samples, 386), and Mansi (57), and two groups of Samoyeds, viz. Nenets (34) and Selkups (271). The total number of individuals is 748. The measurements were taken from Debetz (1951) and Dremov (1984, 1991).

3. Siberians and Mongols. This group is composed of 11 modern series representing Mongoloid populations of central, southern, and eastern Siberia and Mongolia who speak Turkic, Mongolian, Tungus, and isolated languages: Telengits (86), Tuvinians (68), Yakuts (61), Buryats (154), Mongols (109), Tungus (52), Negidals (31), Nanays (23), Ulchi (30), Orochi (18), and Nivkhs (28). The total number of individuals is 660. Measurements are available for all these groups (Debetz, 1951).

4. Eskimos, Aleuts, and Chukchi (Eskimos and Aleuts, who speak related languages, will henceforth be referred to as Eskaleuts).

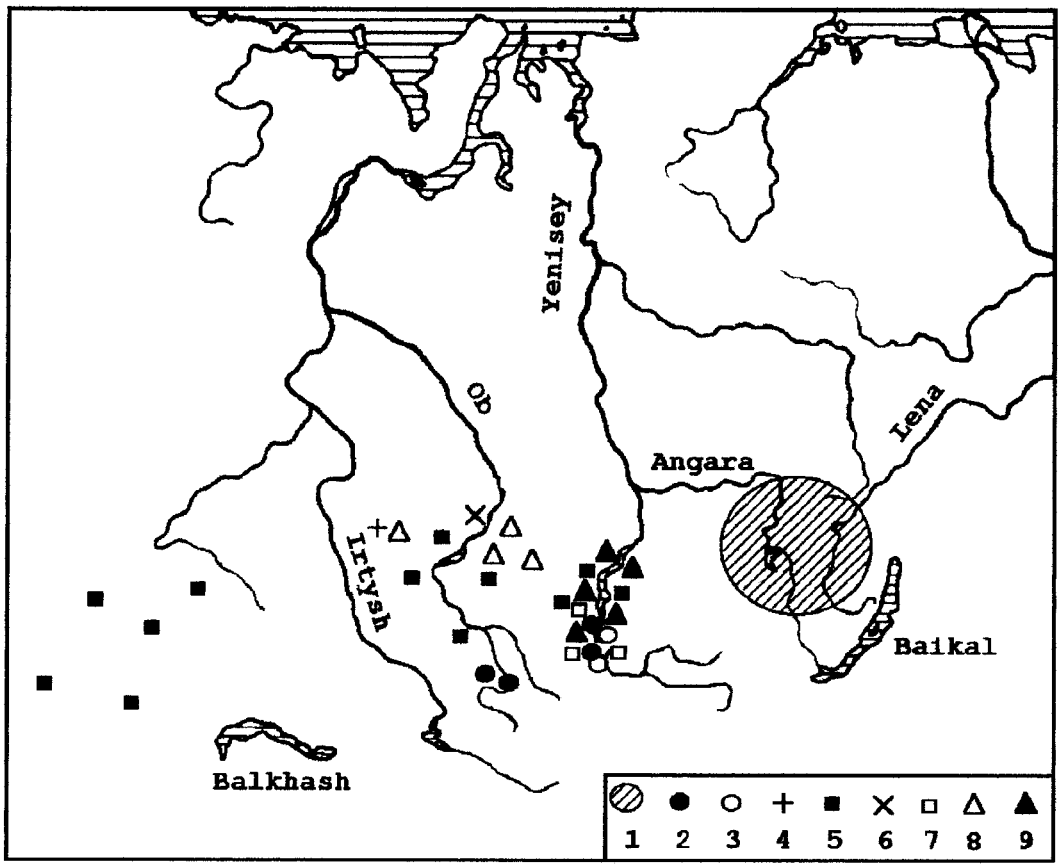

Fig. 1. Location of the most important prehistoric cultures and sites in Southern Siberia and Kazakhstan. 1, Baikal Neolithic and Chalcolithic; 2, Afanasyev; 3, Okunev; 4, Sopka; 5, Andronov; 6, Yelovka; 7, Karasuk; 8, Irmen'; 9, Tagar.

Samples representing modern Eskimos of Chukotka (130), Alaska (122), and Canada (45), Paleo-Eskimos of Chukotka (159) and Alaska (112), modern Aleuts (64), and Chukchi (49) were pooled, the total number of individuals being 681. Measurements were taken from Debetz (1951, 1975, 1986).

5. Indians of North America (mostly modern and late pre- Columbian, second millennium AD). Nonmetric traits were studied in several small samples, the largest ones representing Haida (64), Tlingit (12), Iroquois (23), a group from Cahokia, Illinois (43), and populations of Arizona and New Mexico (15) whose tribal attribution is unknown except that some are Pueblo. Other tribes are represented by no more than three individuals each. The total number of individuals is 157, but the number of observations for some traits is much smaller. For linear measurements, 39 groups represented in Debets's summary (1951) were pooled (this summary is based on data collected by Hrdlička, Oetteking, Neumann, Hooton, Gifford, and others on cranial series representing both Na-Dene and non–Na-Dene tribes from most principal areas of North America). For angular measurements, 14 series measured by Alexseev (1985a) and also diverse in terms of tribal attribution (Tlingit, Haida, Apache, Chinook, Blackfoot, Piegan, Cheyenne, Sioux, Ponka, Huron, Arikara, Pueblo, and unspecified California and Florida Indians) were pooled.

6. Indians of South America (mostly pre-Columbian, first and second millennia AD).

Nonmetric traits were studied in several small groups, mostly from Nazca (70), Ancon (42), and Pachacamac (22), Peru, and Pucará de Tilcara, Argentina (17). Other samples are quite small, and the total number of individuals is 169. For linear measurements, series from Peru, Argentina (Debets, 1951) (unspecified with respect to tribal attribution), and Cuba (Ginzburg, 1967), which was partly populated from South and Central America, were pooled, and angular measurements for these groups were taken from Ginzburg (1967).

7. Baikal Neolithic and Chalcolithic (73). Although most specimens date from the fourth and third millennia BC, some are earlier (fifth and sixth millennia BC). Measurements were taken from Alexseev et al. (1987).

8. Afanasyev culture, the Upper Yenisey and Altai, late third millennium BC (66). Measurements were taken from Alexseev and Gokhman (1984).

9. Okunev culture, the Upper Yenisei, late third or early second millennium BC (142). Measurements are published in Gromov (1997).

10. Sopka, the Upper Ob–Irtysh watershed, late third or early second millennium BC (195). Unpublished measurements made by Gromov were used.

11. Andronov culture, southern Siberia and Kazakhstan, second millennium BC (154). Measurements were taken from Alexseev and Gokhman (1984) and Dremov (1997).

12. Yelovka, the Upper Ob, second millennium BC (78). Unpublished measurements made by Gromov were used.

13. Karasuk culture, the Upper Yenisey, early first millennium BC (229). Measurements were taken from Alexseev and Gokhman (1984) and Gromov (unpublished).

14. Irmen' culture, the Upper Ob and the Ob-Irtysh watershed, early first millennium BC (125). Unpublished measurements made by Gromov were used.

15. Tagar culture, the Upper Yenisey, mid-first millennium BC (117). Measurements are published in Kozintsev (1977).

Because many Amerindian crania are artificially deformed, we have used only facial traits, supraorbital foramina being the only exception. The face is much less affected by deformation than is the brain case (Mizoguchi, 1991). Discrete traits are less affected than measurements (Konigsberg et al., 1993).

Ten craniometric traits were employed, including three angles and an index which are facial and nasal flatness/convexity measures: nasomalar angle (Martin #77, left fronto-malare orbitale–nasion–right fronto-malare orbitale), zygo-maxillary angle (left zygo-maxillare anterior–subspinale–right zygo-maxillare anterior), nasal prominence angle (Martin #75/1, rhinion–nasion–prosthion), and simotic index (SS:SC) (simotic subtense divided by simotic chord). They have been widely used by Russian specialists because they were shown to be remarkably stable over millennia and highly diagnostic in tracing high-level population affinities (Debetz, 1947, 1951, 1968). Unfortunately, because they have not been used by most Western scholars, many fewer Amerindian samples were studied with respect to these traits than with respect to the remaining six linear measurements, which are standard.

The interobserver error is not a serious problem as far as Russian studies are concerned since most Soviet craniometrists were Debetz's students, either in a direct or in an indirect sense. All measurements were made according to a completely standardized technique described in great detail in Alexseev and Debetz (1964). Interobserver error studies were conducted many times, and a high degree of correspondence between the results has been revealed. The problem may become more serious when Russian data are compared with American data. However, Debetz (1951), who prepared a fundamental synopsis of Amerindian craniometry, had paid much attention to methodology and introduced corrections wherever this was necessary and possible.

Nonmetric traits are spheno-maxillary suture, os japonicum trace, infraorbital pattern type II (longitudinal infraorbital suture overlaid by the zygomatic bone), transverse palatine suture index (frequency of sides where the foremost point of the suture coincides neither with the palatine spine nor

TABLE 1. Facial measurements in Eurasian and American male cranial series and their correlation with the first four canonical variates[1]

Group	45	48	55	54	51	52	77	ZMA	SS:SC	75(1)
1. Caucasoids	133.6	70.2	52.1	24.8	42.2	32.9	138.3	126.2	50.9	31.0
2. Uralians	138.6	72.5	53.0	26.0	42.9	34.6	144.2	134.2	38.5	21.3
3. Siberians and Mongols	141.5	77.1	55.4	26.9	43.1	35.2	147.4	138.9	35.4	18.4
4. Eskaleuts and Chukchi	140.5	76.5	54.5	24.3	44.3	36.2	146.0	135.8	39.6	22.8
5. Indians, North America	139.1	73.1	52.3	25.3	43.2	35.3	140.7	129.0	48.1	25.4
6. Indians, South America	137.9	71.2	51.6	24.8	41.9	35.3	143.3	127.7	36.9	22.1
7. Baikal Neolithic	140.8	74.2	54.5	25.9	42.6	33.9	146.1	136.2	46.4	23.3
8. Afanasyev	140.0	71.8	52.6	26.6	44.3	32.6	138.0	128.4	59.4	33.7
9. Okunev	143.8	73.0	52.0	25.9	45.3	33.6	142.4	131.8	53.7	29.3
10. Sopka	138.9	71.5	51.5	25.5	44.6	34.0	144.1	131.8	53.0	23.3
11. Andronov	138.9	69.0	50.4	25.6	43.8	32.1	138.7	128.5	55.2	31.4
12. Yelovka	140.4	70.2	50.5	25.6	44.5	32.8	139.0	133.6	52.4	22.1
13. Karasuk	139.4	73.3	51.6	25.4	43.8	33.3	140.2	129.7	55.0	29.1
14. Irmen'	137.9	70.7	51.8	24.9	44.5	32.0	138.3	126.2	55.6	26.5
15. Tagar	137.6	71.8	51.6	24.9	43.4	32.8	140.3	128.7	53.4	30.5
CV 1	0.32	0.75	0.73	0.13	−0.33	0.86	0.93	0.80	−0.91	−0.91
CV 2	0.60	0.03	−0.12	0.34	0.77	−0.27	0.06	0.42	0.32	−0.22
CV 3	0.38	0.52	0.58	0.49	0.13	−0.04	0.22	0.36	0.09	0.32
CV 4	0.39	0.25	−0.11	−0.33	0.45	0.38	0.11	−0.06	0.05	0.14

[1] Most measurements are numbered and defined according to Martin: 45, bizygomatic breadth; 48, upper facial height; 55, nasal height; 54, nasal breadth; 51, orbital breadth; 52, orbital height; 77, naso-malar angle; 75 (1), nasal prominence angle. Other measurements: ZMA, zygo-maxillary angle; SS:SC, simotic index (Debetz, 1951; Alexseev, 1979a). CV 1–CV 4 are canonical variates.

with the point where it touches the medial palatine suture), and supraorbital foramen. These traits were shown by us to be the most population specific and stable over time (Kozintsev, 1988, 1990, 1992a,b). Scoring methods are described in the same publications. Pooled trait frequencies in males and females were used.

Measurements which pertain to male skulls only were subjected to the canonical variate (CV) analysis, and frequencies of nonmetric traits were subjected first to Anscombe's transformation, widely used in nonmetric studies (Anscombe, 1948) and then to principal component (PC) analysis.

To integrate the results of both multivariate analyses, we treated CVs and PCs as new traits, and their scores were subjected to PC and cluster analysis (unweighted pair-group method). This approach is nontraditional, and in our view it may be optimal for integrating metric and nonmetric data. Because the CVs are uncorrelated, and so are the PCs, the integral correlation matrix has zero elements corresponding to PC-PC and CV-CV correlations and, generally, nonzero elements corresponding to PC-CV correlations.

Correlations between morphological traits can be explained by either or both of the two factors: developmental and/or genetic. Developmental factors can be revealed only on the within-group (individual) level. As our previous results demonstrate, both systems of traits are independent within groups; that is, the correlation between measurements and nonmetric traits used here is negligible on the individual level (Kozintsev, 1988). But if independent traits (or trait sets, as in our case) are correlated on the between-

TABLE 2. Per side frequencies (%) of nonmetric traits in Eurasian and American cranial series and their correlation with the first two principal components[1]

Group	SMS	OJT	IOP II	TPSI	SOF
1. Caucasoids	30.3	9.6	53.9	70.6	33.2
2. Uralians	7.0	15.7	79.3	59.8	40.3
3. Siberians and Mongols	21.3	29.0	64.1	49.2	55.2
4. Eskaleuts and Chukchi	8.7	18.9	37.2	51.5	63.9
5. Indians, North America	7.5	17.6	17.2	44.8	57.9
6. Indians, South America	15.2	11.5	9.0	53.5	43.1
7. Baikal Neolithic	8.7	17.9	43.1	71.2	50.8
8. Afanasyev	16.4	2.5	53.7	61.6	48.3
9. Okunev	29.3	8.0	29.0	58.4	53.3
10. Sopka	18.2	9.8	33.7	60.8	28.2
11. Andronov	40.6	5.8	62.9	64.3	39.5
12. Yelovka	15.9	8.1	46.7	82.7	21.7
13. Karasuk	32.7	8.4	63.4	65.3	45.3
14. Irmen'	39.7	8.3	43.2	70.0	38.7
15. Tagar	31.5	9.3	57.4	75.5	42.4
PC 1	0.68	−0.77	0.38	0.85	−0.81
PC 2	−0.05	0.41	0.89	0.13	0.13

[1] SMS, spheno-maxillary suture; OJT, os japonicum posterior trace; IOP II, infraorbital pattern type II; TPSI, transverse palatine suture index; SOF, supraorbital foramen. PC 1 and PC 2 are principal components. See text for explanations.

TABLE 3. Canonical variate and principal component scores and integral principal component scores in Eurasian and American cranial series[1]

Group	CV 1	CV 2	CV 3	CV 4	PC 1	PC 2	IPC 1	IPC 2
1. Caucasoids	−1.27	−1.41	0.04	−0.61	1.49	0.17	−1.05	1.36
2. Uralians	1.39	−0.23	−0.13	−0.41	−0.40	1.79	1.36	1.23
3. Siberians and Mongols	2.72	0.24	0.79	−0.46	−2.31	1.76	3.12	1.17
4. Eskaleuts and Chukchi	1.86	−0.14	0.37	0.85	−2.43	0.15	2.00	−1.52
5. Indians, North America	0.29	−0.64	−0.51	0.44	−2.78	−1.00	0.52	−2.10
6. Indians, South America	1.07	−1.36	−1.17	0.23	−1.13	−1.98	−0.48	−2.48
7. Baikal Neolithic	1.34	0.20	0.63	−0.67	−0.82	0.50	1.38	1.10
8. Afanasyev	−1.97	−0.15	0.94	−0.09	0.55	−0.29	−0.69	0.80
9. Okunev	−0.68	0.69	0.55	0.87	−0.23	−0.98	−0.26	−1.30
10. Sopka	0.35	0.97	−0.58	0.24	0.52	−0.84	−0.65	−1.02
11. Andronov	−1.78	−0.01	0.05	−0.08	1.61	0.15	−1.30	0.79
12. Yelovka	−0.18	1.57	−0.90	−0.39	2.19	−0.13	−1.42	0.44
13. Karasuk	−0.76	0.06	0.23	0.37	0.92	0.56	−0.32	0.33
14. Irmen'	−1.32	0.58	−0.59	−0.38	1.41	−0.33	−1.55	0.43
15. Tagar	−1.07	−0.38	0.27	0.10	1.41	0.47	−0.66	0.77
Percent of variation	57.5	17.7	11.3	6.9	51.6	19.9	38.1	34.1

[1] CV 1–CV 4 are canonical variate scores based on the analysis of facial measurements, PC 1 and PC 2 are principal component scores based on the analysis of nonmetric traits, and IPC 1 and IPC 2 are integral principal component scores based on the analysis of CV 1, CV 3, CV 4, PC 1, and PC 2 scores from two previous analyses. See text for explanations.

group level, this can only be due to the genetic heterogeneity (geographic variation) within the area studied. It is solely on these cross-systemic between-group correlations that the integral multivariate analysis is based.

RESULTS AND DISCUSSION

Measurements are given in Table 1, frequencies of nonmetric traits in Table 2, and CV and PC scores in Table 3. Both the first canonical variate (CV 1) and the first principal component (PC 1) differentiate the groups along the Caucasoid-Mongoloid vector (Fig. 2). As seen from the factor loadings (Tables 1,2), the trait combination most diagnostic for the Mongoloids is high and flat face, high orbits, high frequency of os japonicum trace and supraorbital foramen, and low frequency of spheno-maxillary suture and low transverse palatine suture index. Caucasoids are characterized by the opposite combination.

As mentioned above, because the metric and nonmetric traits used by us were shown to be independent on the within-group level, the high between-group correlation between CV 1 and PC 1 ($r = 0.76$, $P < 0.001$) must be ascribed to the nature of geographical variation reflected by our samples rather than to developmental factors.

A high degree of concordance between distance matrices based on cranial measurements and nonmetric traits was found in several studies (Corruccini, 1974; Ossenberg, 1977; Yamaguchi, 1977). This fact alone would not imply any specific pattern of intergroup variation. However, as Figure 2 demonstrates, the strong correlation between the two first linear vectors based on independent systems of traits is due to the markedly bipolar pattern of group arrangement (presence of two extremes, Caucasoid and Mongoloid, and a number of transi-

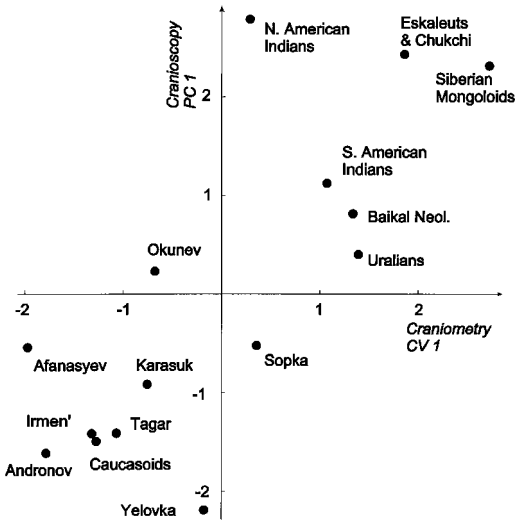

Fig. 2. Position of groups on the first canonical variate (CV 1) based on ten facial measurements traits and on the first principal component (PC 1) based on five nonmetric cranial traits. Signs of PC 1 scores are reversed.

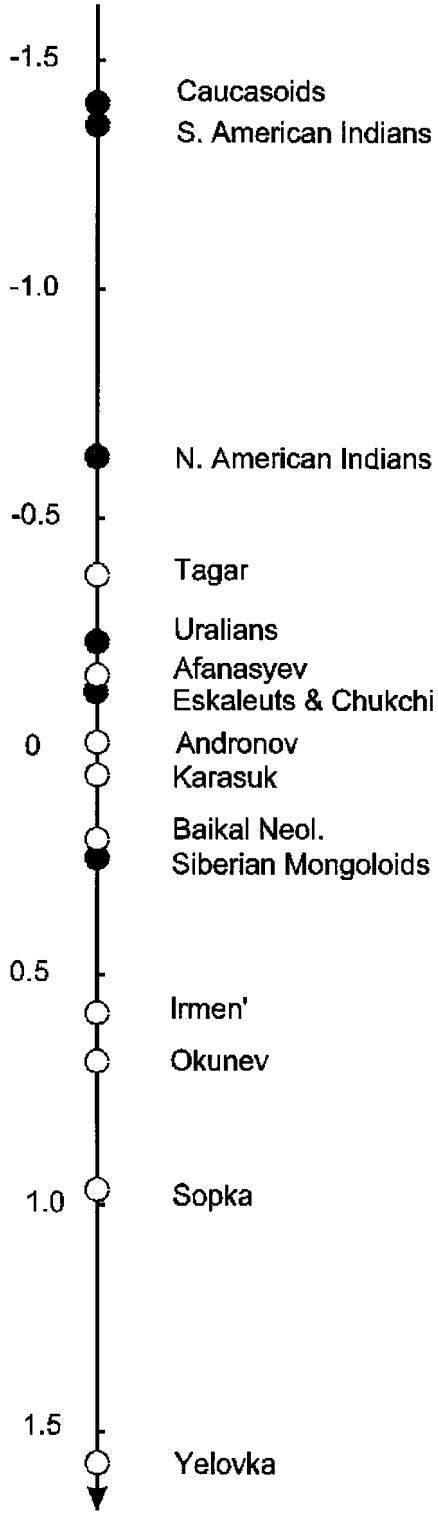

Fig. 3. Position of groups on the second canonical variate (CV 2) based on ten facial measurements. Recent groups are shown by black circles, ancient groups by open circles.

tional populations differing in the amount of admixture).

While all Caucasoids, including the modern sample and six prehistoric groups from southern Siberia, are in the lower left part of the plot (Fig. 2), Okunev and Sopka deviate in the Mongoloid direction, and Uralians, Baikalians, and South Amerindians are even more Mongoloid. Craniometrically, the Mongoloid extreme is represented by Siberians. Both Amerindian groups are much less Mongoloid, while Eskaleuts and Chukchi are intermediate between them and Siberians. Cranioscopically, North American Indians and Eskaleuts and Chukchi are no less Mongoloid than Siberians.

Overall, this pattern reveals essentially nothing new. It was noted long ago that Okunev people are intermediate between Caucasoids and Mongoloids both cranially (Alexseev, 1961) and dentally (Zubov, 1980). Dental observations place Sopka people in the same position (Turner, 1994). And, while Amerindians are again seen to be less Mongoloid than are Siberians, it is again impossible to say whether this is due to Caucasoid admixture (as in the case of Uralians and Baikalians) or to lack of specialization. So at this stage we can only recall Debetz's dictum regarding the inability of available methods to solve the problem.

This is not the whole story, however. On CV 2 (Tables 1, 3; Fig. 3), ancient groups, mostly characterized by broad face and wide orbits, tend to have significantly higher scores than modern ones have regardless of origin (Mann-Whitney $U = 8$, $P < 0.05$). This vector, then, reveals a universal diachronic tendency (evidently related to the gracilization phenomenon) and is accordingly irrelevant for tracing genetical affinities.

On PC 2 (Tables 2, 3; Fig. 4), both Amerindian samples are opposed to all others mostly due to an extremely low frequency of the infraorbital pattern type II. Okunev and Sopka are closest to them.

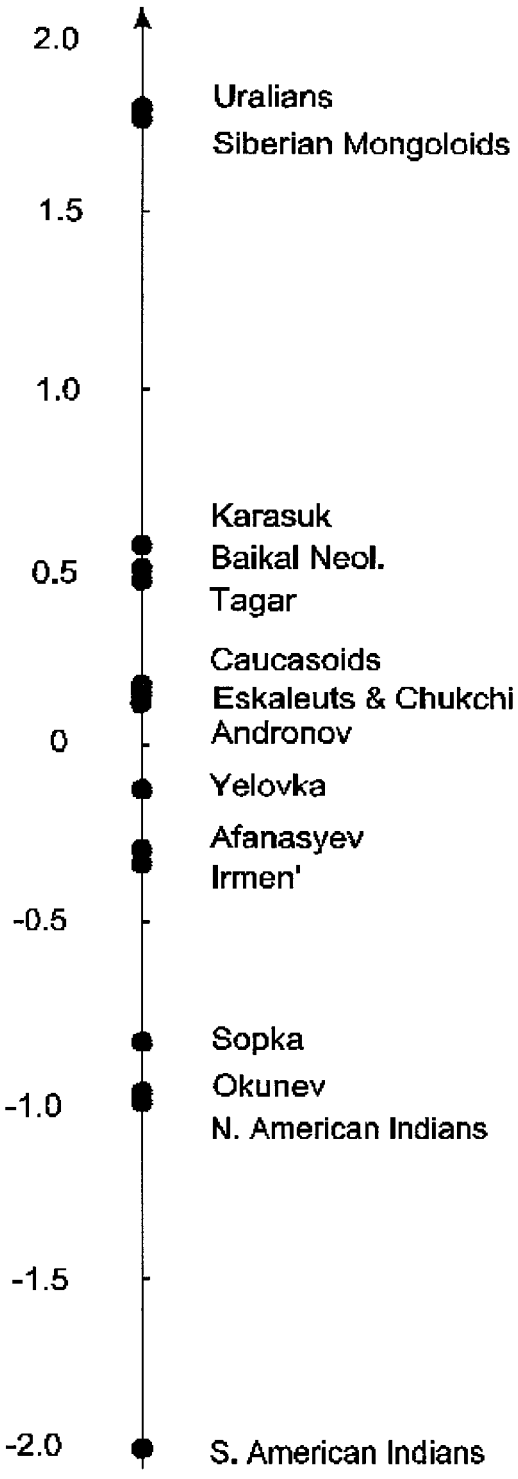

Fig. 4. Position of groups on the second principal component (PC 2) based on five nonmetric cranial traits.

TABLE 4. Coefficients of correlation between the canonical variates (CVs) and principal components (PCs)

	CV 1	CV 3	CV 4	PC 1	PC 2
CV 1	1.00	0.00	0.00	−0.76	0.29
CV 3	0.00	1.00	0.00	−0.17	0.52
CV 4	0.00	0.00	1.00	−0.34	−0.49
PC 1	−0.76	−0.17	−0.34	1.00	0.00
PC 2	0.29	0.52	−0.49	0.00	1.00

PC 1 and PC 2 together account for 72% of the variation of nonmetric traits. Almost the same share of the variation of measurable traits (76%) is accounted for by CV 1, CV 3, and CV 4 taken together (CV 2 is omitted for reasons described above). The most essential information is thus concentrated in these five vectors.

Now we can condense the data even further and combine the two systems by regarding the two PCs and three CVs as new traits and subjecting them to PC analysis. As stated above, it can be expected that if the cross-systemic correlation matrix (Table 4) is subjected to multivariate analysis, the resulting pattern of group relationships will be optimal in that it will integrate all the available information concerning population affinities.

The first two integral PCs (IPCs) again account for 72% of the variation of the initial PCs and CVs and thus for about half of the total variation. But as Figure 5 demonstrates, this is a really meaningful half.

Indeed, the new pattern is not one-dimensional, as in Figure 2, but two-dimensional. Instead of just two extremes, Caucasoid and Mongoloid, we now see three, the third one being represented by Amerindians. So we can no longer subscribe to Debetz's agnostic view concerning Amerindians since we are now quite able to distinguish them from Caucaso-Mongoloid hybrids, such as Neolithic Baikalians or Uralians. As a next step, the plot reveals a distinct gradient which makes perfect sense in both geographical and biological terms: Siberian Mongoloids → Eskaleuts and Chukchi → North American Indians → South American Indians.

The most significant fact that emerges, though, is that Okunev and Sopka are clearly intermediate not between Caucasoids and Siberian Mongoloids but between Cauca-

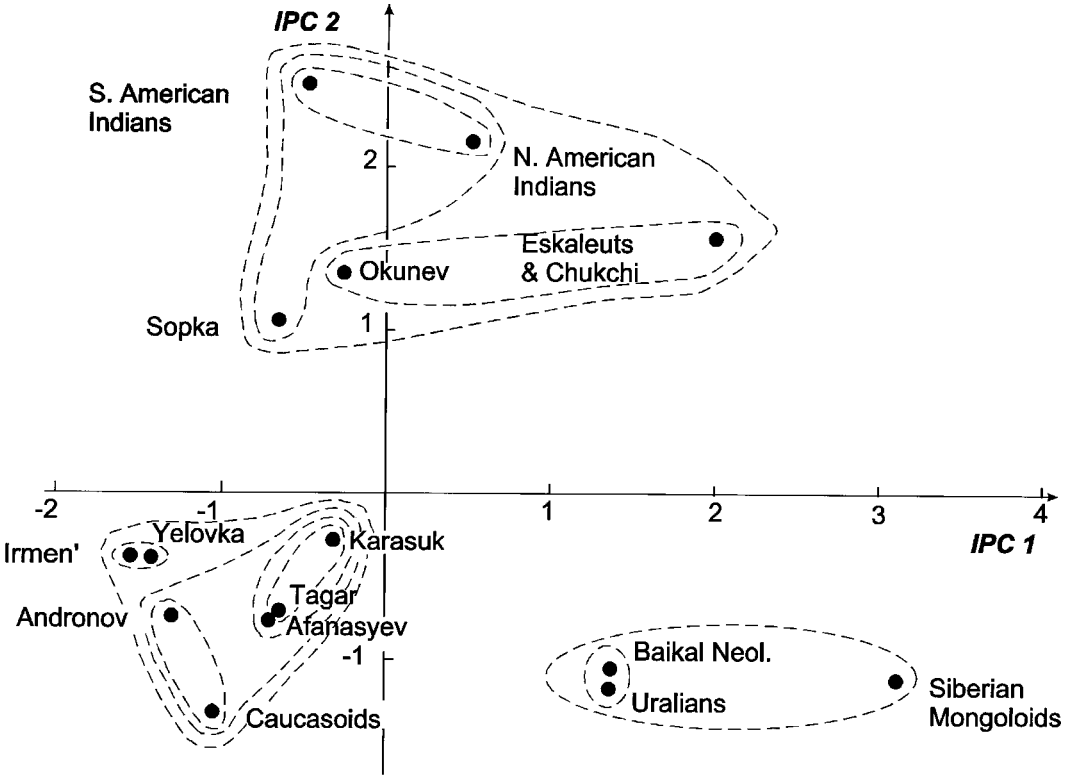

Fig. 5. Position of groups on the first and second integral principal components (IPC 1 and IPC 2) based on the first, third, and fourth canonical vectors derived from the analysis of ten craniometric traits and first and second principal components derived from the analysis of five nonmetric cranial traits. Clusters based on the first three IPCs accounting for two-thirds of the total variation are shown by dashed lines. See text for explanations.

soids and Amerindians. The cluster analysis even joins Okunev with Eskaleuts and Chukchi as well as Sopka with Amerindians. This should not be taken to imply any direct links, of course, but the tendency is evident.

It does appear, then, that people of Okunev culture and Sopka are so far the only likely candidates for the role of collateral relations of Amerindians in Siberia. It remains to be seen whether new archaeological and ethnographic data such as those presented by Lipsky (1969) would support our finding.

Cranial evidence suggests, however, that people of Okunev and Sopka, unlike Amerindians, had absorbed a considerable Caucasoid admixture. Archaeologically, Okunev culture includes both aboriginal Siberian elements and those which can be explained only by migrations from Europe (Savinov, 1997). The within-group skeletal heterogeneity of Okunev populations speaks in favor of incipient hybridization (Gromov, 1997). Too little is known about Sopka at present.

Another intriguing question is whether any modern Siberian populations are genetically closer to Amerindians than are others. Some writers claimed that the Amerindian tendency is present not only in Eskaleuts and Chukchi, whose intermediate position between Siberians and Amerindians is beyond doubt, but also in certain populations of western and southern Siberia (for a review see Levin, 1963). Although neither Levin (1963) nor Alexseev (1979a) supported this view, the issue is still unresolved. Cranioscopically, Koibaly (one of Turkic-speaking Khakassian populations living on the Abakan, southern Siberia), do display an Amerindian tendency, but this finding must be regarded as tentative.

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